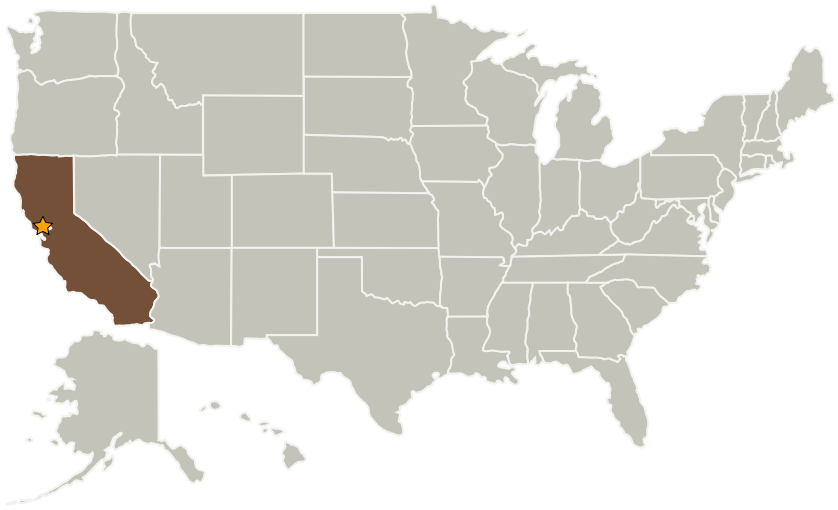
Lab on a Chip LCVR Polarimeter for Exploration of Life Signatures, Phase II

Completed Technology Project (2009 - 2011)

Project Introduction

Life on Earth is unique in many ways; one of its great mysteries is that the building blocks of life on Earth (amino acids, nucleotides, sugars) are all chiral. One optical isomer of each amino acid or nucleic acid was selected by evolution. In our pursuit of finding life on Mars and beyond (Triton, Europa, etc.), it is likely that one of the clues to extant or extinct life could be the detection of non-racemic chiral molecules. This proposal describes the development of a highly miniaturized and ultrasensitive lab-on-a-chip polarimeter that will meet the NASA need to measure chirality in very small volumes of samples at very high sensitivity. The proposal builds on a novel technology that is based on a proprietary design, in which a modulated liquid crystal variable retarder (LCVR) enhances sensitivity and reduces size without sacrificing performance. This detection principle with a long-path-length microfluidic flow cell allows for the measurement of chirality in microliter volumes of samples. The Phase I effort has conclusively demonstrated the technical feasibility of the detection principle. A miniaturized polarimeter with microfluidic flow cell was designed and fabricated. The polarimeter was calibrated and tested with samples. In Phase II, we will build, fully characterize, and deliver a miniature polarimeter with optimized performance, enhanced mechanical stability, and integrated fluid handling capability. The primary goals are to further improve the polarimeter's sensitivity, accuracy, size, weight, reproducibility, measurement speed, and power needs, conduct extensive testing, and deliver a robust prototype, engineering drawings, software, and test results to NASA.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Ames Research Center (ARC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Ames Research Center(ARC)	Lead Organization	NASA Center	Moffett Field, California
Intelligent Optical Systems, Inc.	Supporting Organization	Industry	Torrance, California

Primary U.S. Work Locations
California

Project Transitions

December 2009: Project Start

December 2011: Closed out

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX04 Robotic Systems
  - TX04.3 Manipulation
    - TX04.3.4 Sample Acquisition and Handling